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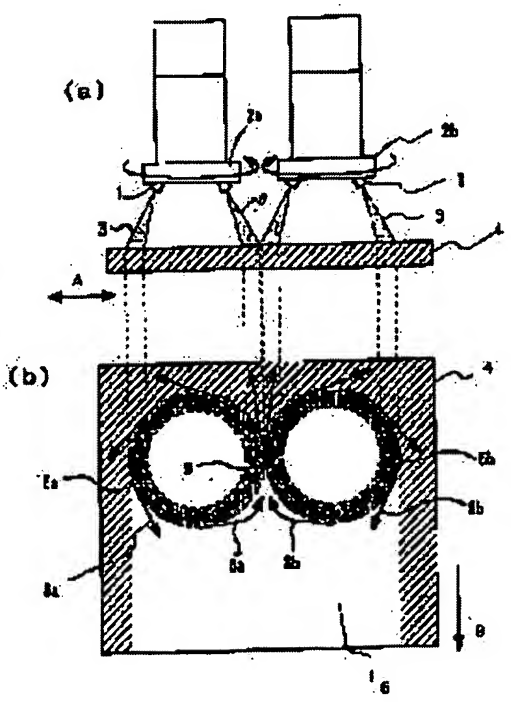
(54) STEEL MEMBER DESCALING EQUIPMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To descale a steel member efficiently and uniformly in the width direction by preventing interference of high-pressure water between adjacent rotating heads when the hot steel coming from a heating furnace is descaled by means of high-pressure water jetted through nozzles attached to multiple rotating heads.



SOLUTION: The rotation directions of multiple rotating heads 2 having high-pressure water jetting nozzles 1, which are provided at prescribed spacings toward a steel member 4 are opposed to each other, or the rotation axes of the rotating heads 2 are mutually inclined in a reverse direction along the moving line of the steel member 4, or the rotating heads 2 are arranged in a manner that every two of them are shifted in position from each other along the moving line of the steel member 4. By jetting the high-pressure water to the steel 4 through the nozzle of such rotating heads, the interference of high- pressure water between the adjacent rotating heads is prevented, and uniform and efficient descaling can be done to the steel member.

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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the descaling equipment of the steel materials for removing hot-rolled scales, such as slab and a steel plate.
[0002]
[Description of the Prior Art] Generally, hot rolled sheet steel and a steel plate are manufactured by rolling out steel materials, such as slab heated by the elevated temperature 1000 degrees C or more with the heating furnace, to predetermined board thickness with a rolling mill.
[0003] At this time, the thick oxide film, i.e., a primary scale, is generating in each field of the hot steel materials taken out from the heating furnace. It becomes the cause of the scale which the crack arose on the surface of the reduction roll in the rolling process when elevated-temperature [that the scale has adhered] steel materials were rolled out, this crack was imprinted by rolled material, and adhered to the reduction roll biting inside rolled material, becoming with a defective when the bite lump of not only degrading the surface quality of a product by this but a scale is deep, and reducing the product yield.
[0004] Moreover, since the rolled material taken out from the heating furnace, such as slab and a steel plate, is elevated temperatures during rolling, in a rolling process, a secondary scale is again formed in a steel material surface. If this secondary scale grows, it will become the cause which a crack produces on the surface of a reduction roll, and a scale nature surface crack produces for a product like a primary scale. Furthermore, in a rolling process, since the heat transfer coefficient of rolled material changes with thickness of a scale when scale unevenness occurs in rolled material, at the time of cooling after rolling, unevenness arises in the quality of the material of a product, and degradation of quality is invited to it.
[0005] Therefore, in case elevated-temperature steel materials are rolled out, to remove uniformly the scale currently generated to steel materials before rolling to homogeneity is needed. Many approaches of injecting and carrying out descaling of the high-pressure water on the surface of steel materials as a descaling means between the heat of elevated-temperature steel materials are proposed (for example, JP,49-37495,B). Drawing 16 is an example of the descaling equipment by injection of such high-pressure water, and is drawing 16 (a). It is an outline front view. Drawing 16 (b) As shown in an outline side elevation, above the elevated-temperature steel materials 4 which move in the direction of an arrow head B When the header 11 which has two or more nozzles 1 is formed crosswise [of the elevated-temperature steel materials 4 / A] and injects high-pressure water 3 towards the front face of the elevated-temperature steel materials 4 from the nozzle 1, the scale on the front face of steel materials is removed.
[0006] A flat spray nozzle is mainly used and a nozzle 1 is drawing 16 (c). As shown in an outline top view, the high-pressure water-injection field 5 from two or more nozzles 1 which receive the elevated-temperature steel materials 4 is overlapped about 20-30mm, respectively, the end panel of the elevated-temperature steel materials 4 is covered by this, and a scale is removed over a field 6.
[0007] However, in the case of the elevated-temperature steel materials which the steel materials with

which elements, such as Si, Cr, nickel, and Cu, were added increase in number, and contain such an element for the improvement in the quality of the material, it is difficult to remove the scale formed in the steel-materials front face by the above-mentioned conventional approach in recent years. then, the pressure of the high-pressure water injected on steel materials and its amount of water -- the method of raising descaling capacity is tried by raising a consistency or optimizing the injection distance of the high-pressure water to steel materials.

[0008] However, in order to heighten the injection pressure of high-pressure water, expensive high pressure pumping and high-pressure piping must be installed, therefore a steep cost rise is caused. moreover, the amount of water of high-pressure water -- if a consistency is raised, as a result of the temperature of the steel materials between heat falling by descaling, the problem from which a subsequent rolled bar affair receives constraint arises.

[0009] Moreover, when the injection distance of the high-pressure water to elevated-temperature steel materials is brought close, it is drawing 16 (c). The injection field 5 of the shown high-pressure water comes it narrow to become. Therefore, since it becomes impossible to have to increase the number of a nozzle 1, to have to extend the spray include angle of each nozzle, consequently to maintain the homogeneity of the anchoring tooth space of a nozzle, piping reinforcement, or a flow rate in order to inject high-pressure water over the crosswise whole surface of the elevated-temperature steel materials 4, it becomes difficult to set up an injection field freely in fact.

[0010] The technique of removing the scale of the front face of the elevated-temperature steel materials 4 as a means to solve the problem mentioned above, using a rotation nozzle is proposed. Namely, drawing 17 (a) With an outline front view, it is drawing 17 (b). High-pressure water 3 is injected towards the elevated-temperature steel materials 4 from a nozzle 1, opening predetermined spacing, attaching two or more nozzles 1 on the periphery of the disc-like rotary head 2, and making the level rotation of the head 2 carry out in the direction of an arrow head, as shown in the outline top view of a nozzle head. Consequently, drawing 17 (c) The high-pressure water-injection field 5 to the front face of the elevated-temperature steel materials 4 can become the shape of a circle of a large area, and can raise descaling capacity so that it may be shown. A scale exfoliates over a field 6. 7 is a scale residual field.

[0011] By carrying out high-speed rotation of the rotary head which has two or more nozzles, washing area can be extended, since the injection area per one of a nozzle is narrow, the injection consistency is high, such a rotation nozzle is a technique put in practical use in the high-pressure-water-washing field, and the outstanding washing capacity is acquired.

[0012] moreover, the amount of water injected by per unit area of processed material since the nozzle is rotated -- the diameter of a rotary head, the number of a nozzle, and the relative-displacement rate of processed material and a rotary head -- being decided -- the amount of water per nozzle -- a consistency and the amount of water injected by per unit area of processed material are controllable independently.

[0013] The technique which the technique which applied the high-pressure-water-washing technique by the rotation nozzle mentioned above to descaling of elevated-temperature steel materials is indicated by JP,7-60333,A (henceforth the advanced technology 1), and applied the rotation nozzle to JP,7-148515,A (henceforth the advanced technology 2) near the reduction roll is indicated.

[0014] if a rotation nozzle performs descaling like advanced technology 1 and 2 -- the amount of water per nozzle -- since a consistency can be raised, descaling capacity can be raised.

[0015] Moreover, maintaining high descaling capacity, since the amount of water per [which is injected by elevated-temperature steel materials] unit area can be set up free by choosing suitably the diameter of a rotary head, the number of a nozzle, and the bearer rate of steel materials, it is possible to control the temperature fall of elevated-temperature steel materials, and since the injection area per rotary head does not change a lot, it can set injection distance as a proper value comparatively easily.

[0016]

[Problem(s) to be Solved by the Invention] With the advanced technology 1 and 2 mentioned above, it faces that a rotation nozzle performs descaling of steel materials, and there are the following problems. That is, according to the rotation nozzle, although the injection area is expanded as compared with the conventional flat nozzle, it is difficult [it] to carry out descaling of the crosswise whole surface of

elevated-temperature steel materials, such as slab, by one set of a rotation nozzle.
[0017] Then, drawing 18 (a) If high-pressure water 3 is injected to the elevated-temperature steel materials 4 from the nozzle 1 which has arranged two or more sets of rotary heads 2 crosswise [of the elevated-temperature steel materials 4], and was prepared in each of two or more sets of rotary heads 2 as shown in an outline front view, it will be drawing 18 (b). It becomes possible to carry out descaling of the cross direction of elevated-temperature steel materials widely so that it may be shown. 6 is a scale exfoliation field and 7 is a scale residual field.
[0018] However, if high-pressure water 3 is injected to the steel materials 4 between heat, interference of the high-pressure water injected on the elevated-temperature steel materials 4 will arise from the nozzle 1 prepared in each of two or more sets of rotary heads 2. That is, as shown in drawing 19 , the high-pressure water injected from the nozzle of one rotary head 2a turns into side-wash water shown in arrow-head 8a after colliding with the elevated-temperature steel materials 4, and the high-pressure water injected from the nozzle of rotary head 2b of another side turns into side-wash water shown in arrow-head 8b, and is diffused around.
[0019] Consequently, side-wash water 8a from one rotary head 2a It invades into high-pressure water-injection field 5b from rotary head 2b of another side. Side-wash water 8b from rotary head 2b of another side In order to invade into high-pressure water-injection field 5a from one rotary head 2a, it is checked that the high-pressure water injected from two sets of nozzles, rotary head 2a and 2b, collides with the front face of the elevated-temperature steel materials 4 directly. Consequently, in the part which the staging area 5a and 5b, i.e., high-pressure water-injection fields, of 2b of two sets, rotary head 2a and 2b, approaches, descaling capacity declines and the problem which scale unevenness generates arises.
[0020] In the advanced technology 1, although arrangement of the nozzle attached in the revolving shaft of one set of a rotary head is limited, about preventing interference of the high-pressure water between the adjoining rotary heads, it is not taken into consideration at all. Moreover, in the advanced technology 2, by making the revolving shaft of a rotary head incline in an opposite direction with a rolling direction, although it bites and lump prevention is aimed at, similarly about preventing interference of the high-pressure water between the adjoining rotary heads to the reduction roll of an exfoliation scale, it is not taken into consideration at all.
[0021] Therefore, the purpose of this invention solves the problem mentioned above, faces it carrying out descaling with the high-pressure water injected from the nozzle in which elevated-temperature steel materials taken out from the heating furnace, such as hot slab and a steel plate, were attached by two or more sets of rotary heads, prevents interference of the high-pressure water between the adjoining rotary heads, and is to offer the equipment which can carry out descaling to homogeneity in high efficiency crosswise.
[0022]
[Means for Solving the Problem] Invention according to claim 1 opens predetermined spacing towards the steel materials which should be carried out descaling. High-pressure water is injected towards said steel materials from said nozzle, two or more sets of the rotary heads which have a nozzle for high-pressure water injection respectively being prepared, and rotating said rotary head. In the descaling equipment of steel materials from which the scale generated to said steel materials is removed, it has the description in said thing [having made mutually two or more each hands of cut of the rotary head of a radical into hard flow].
[0023] Invention according to claim 2 is set to the above-mentioned descaling equipment. The revolving shaft of two or more sets of rotary heads It has the description along migration Rhine of steel materials to carry out the predetermined include-angle inclination by turns in the opposite direction. Invention according to claim 3 It has the description for each revolving shaft of two or more sets of rotary heads to carry out the predetermined include-angle inclination every other set along migration Rhine of said steel materials towards the direction where the migration direction and/or the migration direction are opposite.
[0024] In equipment according to claim 2 or 3, each hand of cut of two or more sets of rotary heads of invention according to claim 4 is hard flow mutually, as for invention according to claim 5, whenever

[tilt-angle / of the rotary head toward which the revolving shaft inclines] is within the limits of 5-30 degrees, and invention according to claim 6 has the description for the difference of whenever [tilt-angle / of the adjoining rotary head toward which the revolving shaft inclines] to be 10 degrees or less.
[0025] Invention according to claim 7 has the description in the above-mentioned descaling equipment for two or more sets of rotary heads to shift the location, and to be prepared for every set, along migration Rhine of steel materials.
[0026] In equipment according to claim 7, each hand of cut of two or more sets of rotary heads of invention according to claim 8 is hard flow mutually. Invention according to claim 9 The revolving shaft of two or more sets of rotary heads is carrying out the predetermined include-angle inclination by turns along migration Rhine of steel materials in the opposite direction. Invention according to claim 10 It has the description for the revolving shaft of two or more sets of rotary heads to carry out the predetermined include-angle inclination every other set along migration Rhine of steel materials towards the direction where the migration direction and/or the migration direction are opposite.
[0027] Invention according to claim 11 is within the limits whenever [tilt-angle / of the rotary head toward which the revolving shaft inclines / whose] is 5-30 degrees in equipment according to claim 9 or 10, and invention according to claim 12 has the description for the difference of whenever [tilt-angle / of the adjoining rotary head toward which the revolving shaft inclines] to be 10 degrees or less.
[0028] It faces carrying out descaling with the high-pressure water injected from the nozzle in which the hot steel materials taken out from the heating furnace were attached by two or more sets of rotary heads according to the equipment of this invention. The side-wash water on elevated-temperature steel materials of the high-pressure water injected from each nozzle of two or more sets of rotary heads Interference of the high-pressure water between the adjoining rotary heads by trespassing upon the high-pressure water-injection field on steel materials is prevented. The fall of the descaling capacity in a rotary head staging area can be controlled, and descaling of the hot steel materials can be carried out to homogeneity in high efficiency crosswise [the] by this.
[0029]
[Embodiment of the Invention] Next, the descaling equipment of this invention is explained below at a detail, referring to a drawing. Drawing 1 (a) The outline front view of this invention showing equipment [like] the 1st operative condition, and drawing 1 (b) Drawing 1 (a) It is the outline top view showing the condition after the high-pressure water injected from the nozzle in the shown equipment collides with the steel materials between heat. Drawing 1 (a) Above the elevated-temperature steel materials 4 which move in the direction of an arrow head B, so that it may be shown Predetermined spacing is opened on the crosswise same line, for example, disc-like rotary head 2a and 2b of two sets are perpendicularly arranged towards the elevated-temperature steel materials 4. To each of rotary head 2a and 2b It is the same as that of conventional equipment to open predetermined spacing on the periphery, for two or more nozzles 1 to be attached, and for high-pressure water 3 to be injected towards the elevated-temperature steel materials 4 from a nozzle 1, and to carry out descaling of the elevated-temperature steel materials 4.
[0030] The hand of cut of two-set which adjoin [in / the 1st operative condition / equipment / like] of rotary heads 2of this invention a, and 2b is hard flow mutually. Consequently, drawing 1 (b) Since the flow of the side-wash water 8a and 8b on the elevated-temperature steel materials 4 by the high-pressure water injected from each nozzle 1 of one rotary head 2a and rotary head 2b of another side becomes in the same direction, side-wash water 8a and 8b does not trespass upon the high-pressure water-injection fields 5a and 5b on steel materials 4, so that it may be shown.
[0031] Therefore, adjoining rotary head 2a and the high-pressure water injected from each nozzle 1 of 2b Since it collides with the front face of the elevated-temperature steel materials 4 directly, without being prevented by side-wash water 8a and 8b In the part which the high-pressure water-injection fields 5a and 5b approach, descaling capacity declines like before, a problem which scale unevenness generates does not arise, and the scale of the large field 6 exfoliates.
[0032] It is drawing showing the condition after the high-pressure water with which the outline top view of this invention showing equipment [like] the 2nd operative condition was injected for drawing 2 , and

that outline side-face side and drawing 4 were injected for drawing 3 from the nozzle collides with elevated-temperature steel materials. As shown in drawing 2 and drawing 3 , it sets to the equipment of this embodiment. Above the elevated-temperature steel materials 4 which move in the direction of an arrow head B, opened predetermined spacing and have been arranged at the crosswise same line top. It has two or more nozzles 1, for example, each revolving shaft of three sets of the rotary heads 2 which consist of 1st head 2a, 2nd head 2b, and 3rd head 2c is carrying out the predetermined include-angle inclination of the migration direction B and migration direction B by turns in the opposite direction along migration Rhine of the elevated-temperature steel materials 4, respectively.

[0033] Namely, in the example of illustration, the revolving shaft of 1st head 2a of both sides and 3rd head 2c inclines in the migration direction B of the elevated-temperature steel materials 4, and the revolving shaft of the middle 2nd head 2b inclines in the direction opposite to the migration direction of the elevated-temperature steel materials 4.

[0034] As shown in drawing 4 , consequently, the side-wash water 8a, 8b, and 8c on the elevated-temperature steel materials 4 of inclined rotary head 2a, 2b, and the high-pressure water injected from each nozzle of 2c Although the part serves as flow towards direction 9b opposite to the inclination direction of a rotary head, the flow towards the same direction 9a as the inclination direction of a rotary head becomes dominant, the rate of the side-wash water which flows in each direction rivals, and the interference film 10 is generated between the high-pressure water-injection fields 5a and 5b and 5c.

[0035] Therefore, it is prevented that the side-wash water 8a, 8b, and 8c on the steel materials 4 between heat of the high-pressure water injected from the nozzle 1 of the adjoining each rotary head 2 trespasses upon the high-pressure water-injection fields 5a, 5b, and 5c on the elevated-temperature steel materials 4, and it can control the fall of the descaling capacity in a rotary head staging area.

[0036] Each hand of cut of rotary head 2a, 2b, and 2c may be the same direction, or may be hard flow mutually like equipment [like] the 1st operative condition. In addition, if it is made to incline in the migration direction of the elevated-temperature steel materials 4, and the migration direction and an opposite direction by turns and hard flow is made to rotate adjoining rotary head 2a, 2b, and 2c by turns as mentioned above, the fall of descaling capacity can be controlled more certainly.

[0037] Drawing 5 , drawing 6 , and drawing 7 are the outline top views of this invention showing equipment [like] the 3rd operative condition. In the equipment of this embodiment, the revolving shaft of two or more sets of the disc-like rotary heads 2 which have two or more nozzles 1, respectively which opened predetermined spacing on that crosswise same line, and was established above the elevated-temperature steel materials 4 inclines every other set along migration Rhine of the elevated-temperature steel materials 4 to the same direction as the steel-materials migration direction B, or hard flow, respectively.

[0038] That is, in the example shown in drawing 5 , the revolving shaft of 1st head 2a, 3rd head 2c, and 5 head 2e is carrying out the predetermined include-angle inclination in the migration direction B of the elevated-temperature steel materials 4 among disc-like rotary head 2a and 2b of five sets, and 2c, 2d and 2e, and the 2nd head 2b and a 4th head 2d revolving shaft are perpendicular towards the elevated-temperature steel materials 4. In the example shown in drawing 6 , moreover, the revolving shaft of 1st head of the above 2a, 3rd head 2c, and 5 head 2e In the example which is carrying out the predetermined include-angle inclination in the direction opposite to the migration direction B of the elevated-temperature steel materials 4 and which was shown in drawing 7 The revolving shaft of 1st head of the above 2a, and 5th head 2e It inclines in the migration direction B of the elevated-temperature steel materials 4, the revolving shaft of 3rd head 2c inclines in the direction opposite to the migration direction B of the elevated-temperature steel materials 4, and the 2nd head 2b and a 4th head 2d revolving shaft are perpendicular towards the elevated-temperature steel materials 4. In addition, hard flow is mutually [every other / the same direction or / set] sufficient as all of each rotary head 2a, 2b, and the hand of cut of 2c, 2d, and 2e.

[0039] Drawing 8 (a) The outline front view of this invention showing equipment [like] the 4th operative condition, and drawing 8 (b) It is drawing showing the condition after the high-pressure water injected from the nozzle collides with elevated-temperature steel materials. As shown in a drawing, in

the equipment of this embodiment, along migration Rhine of the elevated-temperature steel materials 4, two or more sets of the disc-like rotary heads 2 which opened predetermined spacing crosswise [that] and were perpendicularly prepared in it and which have two or more nozzles 1, respectively shift that location above the elevated-temperature steel materials 4 which move in the direction of an arrow head B, and they are prepared in it for every set. For example, drawing 8 (b) 1st head 2a and 3rd head 2c of both sides among three sets of the rotary heads which consist of 1st head 2a, 2nd head 2b, and 3rd head 2c so that it may be shown It is arranged crosswise [of the elevated-temperature steel materials 4] at the same line top, and the central 2nd head 2b shifts the location by at least one set ahead [of the elevated-temperature steel materials 4 / migration direction], and is arranged.

[0040] Thus, by rotary head 2a and 2b of three sets, and 2c shifting the location, and arranging them for every set Drawing 8 (b) Are based on the high-pressure water 3 injected from each nozzle 1 of each rotary head so that it may be shown. The side-wash water 8a, 8b, and 8c on the elevated-temperature steel materials 4 High-pressure water-injection field 5a on the elevated-temperature steel materials 4, As a result of preventing invading into 5b and 5c and controlling the fall of the descaling capacity in the middle 2nd head 2b, generating of scale unevenness is prevented and the scale of the large field 6 exfoliates.

[0041] Drawing 9 (a) The outline top view of this invention showing equipment [like] the 5th operative condition, and drawing 9 (b) It is drawing showing the condition after the high-pressure water injected from the nozzle collides with elevated-temperature steel materials. As shown in a drawing, it sets to the equipment of this embodiment. Two or more sets of the disc-like rotary heads 2 which opened predetermined spacing crosswise [the] and were prepared above the elevated-temperature steel materials 4 which move in the direction of an arrow head B and which have two or more nozzles 1, respectively For every set, the location is shifted, and it is arranged along migration Rhine of the elevated-temperature steel materials 4, and the revolving shaft inclines by turns in the migration direction B, and the migration direction B and opposite direction of elevated-temperature steel materials.

[0042] Namely, drawing 9 (a) In the shown example, 1st head 2a and 3rd head 2c of both sides among disc-like rotary head 2a and 2b of three sets, and 2c It is arranged on the crosswise same line of the steel materials 4 between heat, and the revolving shaft is carrying out the predetermined include-angle inclination towards the migration direction B of the elevated-temperature steel materials 4. The central 2nd head 2b The location is shifted by at least one set behind [migration direction] the elevated-temperature steel materials 4, and it is arranged, and the revolving shaft is carrying out the predetermined include-angle inclination in the direction opposite to the migration direction B of the elevated-temperature steel materials 4.

[0043] Thus, as by arranging the rotary head 2 described equipment [like] the 2nd operative condition The side-wash water 8a, 8b, and 8c on the elevated-temperature steel materials 4 of rotary head 2a, 2b, and the high-pressure water 3 injected from each nozzle of 2c The flow towards the same direction 9a as a rotary head becomes dominant, it becomes the flow which the part turned to direction 9b opposite to the inclination direction of the above-mentioned rotary head, and the interference film 10 generates between the high-pressure water-injection fields 5a and 5b and 5c.

[0044] Therefore, it is prevented that the side-wash water 8a, 8b, and 8c on the elevated-temperature steel materials 4 of the high-pressure water injected from the nozzle 1 of the adjoining each rotary head 2 trespasses upon the high-pressure water-injection fields 5a, 5b, and 5c on the elevated-temperature steel materials 4, and it can control the fall of the descaling capacity in a rotary head staging area.

[0045] Drawing 10 is drawing of this invention showing another example of equipment [like] the 5th operative condition, and is drawing 10 (a). An outline front view and drawing 10 (b) It is an outline top view. In this example, crosswise [of the elevated-temperature steel materials 4] Disc-like rotary head 2a, 2b of seven sets, 2c, 2d, 2e, 2f, and 2g are prepared, and the all meet migration Rhine of the elevated-temperature steel materials 4. It shifts [at least one] and is arranged in the shape of [each] zigzag. And the revolving shaft of 1st head 2a and 5th head 2e It inclines in the same direction as the migration direction B of the elevated-temperature steel materials 4, and 3rd head 2c and a 7 head 2g

revolving shaft incline in the opposite direction, and the revolving shaft (2nd head 2b and 4th head 2d and 6th head 2f) of the migration direction B of the elevated-temperature steel materials 4 is perpendicular towards the elevated-temperature steel materials 4. And each rotary head 2a, 2b, and a hand of cut (2c, 2d, 2e, 2f, and 2g) are hard flow mutually.

[0046] Drawing 11 is the outline top view of this invention showing still more nearly another example of equipment [like] the 5th operative condition. In this example, a rotary head 2 between [each] 1st head 2a [which opened predetermined spacing on the crosswise same line of the elevated-temperature steel materials 4, and has been arranged], 2nd head 2b, and 3rd head 2c, and 1st head 2a, the 2nd head and 3rd head 2c The location is shifted by at least one set along migration Rhine of the elevated-temperature steel materials 4, and it consists of 4th head 2d and 5th head 2e which opened predetermined spacing on the crosswise same line of the elevated-temperature steel materials 4, and has been arranged. The hand of cut of 1st head 2a, 2nd head 2b, and 3rd head 2c, and 4th head 2d and 5th head 2e is hard flow mutually.

[0047] Drawing 12 is the outline top view of this invention showing still more nearly another example of equipment [like] the 5th operative condition. In this example, a rotary head 2 between 1st head 2a and the 2nd head 2b which opened predetermined spacing on the crosswise same line of the elevated-temperature steel materials 4, and have been arranged, and the above-mentioned 1st head 2a and the 2nd head 2b Between 3rd head 2c and 4th head 2d which shifted the location by at least one set behind [migration direction] the elevated-temperature steel materials 4, opened predetermined spacing on the crosswise same line of the elevated-temperature steel materials 4, and has been arranged, and the above-mentioned 3rd head 2c and 4th head 2d 5th head 2e which shifted the location by at least one set along migration Rhine of the elevated-temperature steel materials 4, and has been arranged from -- it has become. And the hand of cut of 1st head 2a and the 2nd head 2b, 3rd head 2c and 4th head 2d, and 5th head 2e is hard flow mutually.

[0048] In the equipment of each embodiment of this invention mentioned above, especially the class of nozzle 1 attached in each rotary head 2 is not limited, and should just choose a flat spray nozzle, a rod-like nozzle, etc. suitably. Moreover, what is necessary is not to limit the number of nozzles 1 especially, either and just to choose it suitably. Usually, 2-8 pieces are suitable.

[0049] The distance between the elevated-temperature steel materials 4 of a rotary head 2 should just choose the most suitable value according to the flow rate of the nozzle 1 attached in a rotary head 2, and the pressure of high-pressure water. Usually, the range of about 40-200mm is suitable.

[0050] The rotational frequency of a rotary head 2 is set as a suitable value in relation with the passing speed of the elevated-temperature steel materials 4. Usually, it is desirable to set up so that high-pressure water may be injected twice [at least] or more by the same location of the elevated-temperature steel materials 4. Moreover, it is desirable that they are two or more 100 kg/cm, and if the injection pressure of high-pressure water considers as two or more 300 kg/cm, it is more desirable.

[0051] As for whenever [tilt-angle / in the case of making the revolving shaft of a rotary head 2 incline], it is desirable that it is within the limits of 5-30 degrees. At less than 5 degrees, the direction constraint effectiveness of side-wash water becomes [whenever / tilt-angle] inadequate, and on the other hand, if whenever [tilt-angle] exceeds 30 degrees, the descaling effectiveness will fall extremely.

[0052] Moreover, as for the difference of whenever [revolving-shaft tilt-angle / of two sets of the adjoining rotary heads 2], considering as 10 degrees or less is desirable. Thus, by making the difference of whenever [tilt-angle] into 10 degrees or less, the interference film is formed in two sets of the high-pressure water-injection fields of a rotary head where the rate of the side-wash water which flows in each direction rivals and adjoins, it is prevented that side-wash water trespasses upon a high-pressure water-injection field by this, and the fall of the descaling capacity in the staging area of two sets of rotary heads of it is lost. If the difference of whenever [above-mentioned tilt-angle] exceeds 10 degrees, it will be hard coming to generate such an operation.

[0053] In the explanation about the equipment of each embodiment of this invention mentioned above, the disc-like rotary head 2 in which two or more nozzles 1 were attached Although all are arranged above the elevated-temperature steel materials 4 and the high-pressure water injected towards the top

face of the elevated-temperature steel materials 4 removes the scale on the top face of steel materials from a nozzle 1 which operative condition -- equipment [like] -- also setting -- for example -- this invention, as equipment [like] is shown in drawing 13 the 1st operative condition Disc-like rotary head 2a and 2b with the high-pressure water 3 which arranges under the elevated-temperature steel materials 4, and is injected towards the inferior surface of tongue of the elevated-temperature steel materials 4 from the nozzle 1 You may make it remove the scale under steel materials. Further with the upper part of the elevated-temperature steel materials 4, and the high-pressure water which arranges rotary head 2a and 2b caudad, and is injected towards the top face and inferior surface of tongue of the elevated-temperature steel materials 4 from a nozzle 1 You may make it remove both the scales of a steel-materials top face and an inferior surface of tongue.

[0054]

[Example] Next, this invention is further explained to a detail, while an example contrasts with the example of a comparison. [example 1] Equipment [like] is used the 1st operative condition. this invention shown in drawing 1 -- according to the following conditions Making hard flow rotate mutually two sets of the rotary heads arranged on the same line High-pressure water is injected towards the test panel made from a lead plate from the flat spray nozzle attached in each head. They are 10mpm(s) about said test panel. Equipment is used conventionally which shows the erosion condition of the test panel when carrying out both-way migration 5 times, and carrying out erosion to drawing 18 , and, similarly two sets of rotary heads are shown in Table 1 according to the following conditions as compared with the erosion condition at the time of making it rotate in the same direction. In addition, the erosion depth of the test panel made from a lead plate was measured with the laser surface roughness meter.

[0055]

Diameter of a rotary head : Rotational frequency of 250mm rotary head : 500 rpm nozzle number : 4 nozzle height : 80mm nozzle spray angle (theta): Amount of water of 5-degree high-pressure water : 0.4 l/sec Injection pressure of this high-pressure water : The valuation basis of a 300 kg/cm2 erosion condition is as follows.

[0056]

O : Homogeneity erosion O : It is homogeneity erosion ** mostly. : It is x with erosion unevenness a little. : Those with non-erosion partial [0057]

[Table 1]

表1

No.	2台の回転ヘッドの回転方向	傾斜角(°)	均一性※	備考
1	反対方向	0	○	本発明
2	反対方向	3	○	本発明
3	反対方向	5	◎	本発明
4	反対方向	10	◎	本発明
5	反対方向	15	◎	本発明
6	反対方向	30	◎	本発明
7	同一方向	0	×	比較例
8	同一方向	5	△	比較例

[0058] In the case of example No.of this invention 1-6 which made hard flow rotate two sets of rotary heads mutually, as compared with the case of conventional example No.7 which made it rotate in the same direction, and 8, erosion of the test panel was carried out to homogeneity, and it was distinct that the DESUKERINGU effectiveness is improving so that clearly from Table 1.

[0059] [Example 2] The revolving shaft of two or more sets of the adjoining rotary heads which are shown in drawing 2 -4 this invention made [the opposite direction] to carry out a predetermined include angle mutually, using equipment [like] (however, a rotary head two sets) the 2nd operative condition, and making hard flow rotate each rotary head of each other High-pressure water is injected

towards the test panel made from a lead plate from the flat spray nozzle attached in each head. They are 10mpm(s) about said test panel. As compared with the erosion condition which shows the erosion condition of the test panel when carrying out both-way migration 5 times, and carrying out erosion in drawing 18 when each revolving shaft of each rotary head uses equipment conventionally [perpendicular], it is shown in Table 2. In addition, the measuring method and erosion depth valuation basis of a test condition and the erosion depth are the same in having stated to the example 1.

[0060]

[Table 2]

表2

No.	傾斜角α1 (度)	傾斜角α2 (度)	|α1-α2| (度)	均一性	備考
1	3	3	0	○	本発明
2	5	5	0	◎	本発明
3	10	10	0	◎	本発明
4	15	15	0	◎	本発明
5	20	20	0	◎	本発明
6	25	25	0	◎	本発明
7	30	30	0	◎	本発明
8	5	10	5	◎	本発明
9	5	15	10	◎	本発明
10	5	20	15	○	本発明
11	15	40	25	△	本発明
12	30	40	10	○	本発明
13	3	0	3	△	本発明
14	5	0	5	○	本発明
15	15	0	15	△	本発明
16	0	3	3	△	本発明
17	0	5	5	○	本発明
18	0	15	15	△	本発明
19	0	0	0	×	比較例

※1 噴射角α1：ライン入側方向
噴射角α2：ライン出側方向

[0061] In the case of example No.of this invention 1-18 which made hard flow incline mutually, the revolving shaft of each rotary head was all carrying out erosion of the revolving shaft of each rotary head to homogeneity as compared with the case of perpendicular conventional example No.19, and, as for the test panel, it was distinct that the DESUKERINGU effectiveness is improving so that clearly from Table 2. In addition, No.11 to which the difference of the tilt angle of the rotary head which whenever [tilt-angle / of a rotary head] exceeds 30 degrees, and adjoins exceeded 10 degrees, and No.15 to which No.13 [less than 5-degree], No.16, and the adjoining difference of the tilt angle of a rotary head exceeded [whenever / tilt-angle / of a rotary head] 10 degrees were not what trouble produces practically, although erosion unevenness occurred a little.

[0062] [example 3] this invention by which two or more sets of the rotary heads shown in drawing 8 shifted that location mutually, and they have been arranged, using equipment [like] (however, a rotary head two sets) the 4th operative condition, and making the same direction or hard flow rotate each rotary head High-pressure water is injected towards the test panel made from a lead plate from the flat spray nozzle attached in each head. They are 10mpm(s) about said test panel. As compared with the erosion condition at the time of using equipment conventionally by which each rotary head has been arranged together with the same line top which shows the erosion condition of the test panel when carrying out both-way migration 5 times, and carrying out erosion in drawing 18 , it is shown in Table 3. In addition,

the measuring method and erosion depth valuation basis of a test condition and the erosion depth are the same in having stated to the example 1.

[0063]

[Table 3]

表 3

No.	ライン長手方向の設置位置	回転方向	傾斜角(°)	均一性※	備考
1	ずらして配置	同一方向	0	○	本発明
2	ずらして配置	同一方向	5	◎	本発明
3	ずらして配置	反対方向	0	◎	本発明
4	ずらして配置	反対方向	5	◎	本発明
5	ずらして配置	反対方向	10	◎	本発明
6	ずらして配置	反対方向	15	◎	本発明
7	同じ配置	同一方向	0	×	比較例
8	同じ配置	反対方向	0	△	比較例
9	同じ配置	反対方向	5	△	比較例

[0064] In the case of example No.of this invention 1-6 by which each rotary head shifted the location and each other has been arranged, as compared with the case of conventional example No.7-9 by which each rotary head has been arranged together with the same line top, erosion of the test panel was carried out to homogeneity, and it was distinct that the DESUKERINGU effectiveness is improving so that clearly from Table 3.

[0065] [Example 4] To the close side of the rougher in the production line of hot rolled sheet steel Equipment [like] is installed the 2nd operative condition. this invention that rotates to hard flow mutually [the revolving shaft of two or more sets of the adjoining rotary heads which are shown in drawing 2 is mutually inclined and established in the opposite direction, and] -- 1 m/s The incidence rate of the scale nature surface crack when injecting high-pressure water by the pressure of 300 kg/cm2, and performing descaling to the elevated-temperature slab which moves at a rate, and the amount of descent of slab temperature are investigated. When the descaling equipment by the rotary head which it is prepared in perpendicularly [conventional] the result is shown in drawing 18 , and is rotated in the same direction is used (example 1 of a comparison), And as compared with the case (example 2 of a comparison) where the descaling equipment of the conventional flat spray type shown in drawing 16 is used, it is shown in drawing 14 and drawing 15 .

[0066] The incidence rate of the scale nature surface crack in the case of the example 1 of a comparison is about 1.3%, and, in this invention, a scale nature surface crack was hardly generated to the incidence rate of the scale nature surface crack in the case of the example 2 of a comparison having been about 2.8% so that clearly from drawing 14 .

[0067] Moreover, there were very few amounts of slab temperature reductions in this invention at about 10 degrees C to the amount of slab temperature reductions in the case of the example 1 of a comparison having been about 12 degrees C, and the amount of slab temperature reductions in the case of the example 2 of a comparison having been about 50 degrees C so that clearly from drawing 15 .

[0068] [Example 5] To the close side of the rougher in the production line of an elevated-temperature steel plate Equipment [like] is installed the 5th operative condition. this invention by which two or more sets of the adjoining rotary heads which are shown in drawing 9 have been arranged mutually [shift that location in the migration direction of each elevated-temperature steel materials, and] by inclining in the opposite direction -- It is 1 m/s like an example 4. As opposed to the slab between heat which moves at a rate The incidence rate of the scale nature surface crack when injecting high-pressure water by the pressure of 300 kg/cm2, and performing descaling and the amount of descent of slab temperature are investigated. When the descaling equipment by the rotary head which it is prepared in perpendicularly [conventional] the result is shown in drawing 18 , and is rotated in the same direction

was used (example 1 of a comparison), it compared with the case (example 2 of a comparison) where the descaling equipment of the conventional flat spray type shown in drawing 16 is used.
[0069] Consequently, it was almost the same as drawing 14 which shows the comparison of the incidence rate of the scale nature surface crack in an example 4, and drawing 15 which shows the comparison of the amount of slab temperature reductions, and in this invention, a scale nature surface crack was hardly generated, and it had very few amounts of slab temperature reductions in this invention at about 10 degrees C.
[0070]
[Effect of the Invention] As explained above, interference of the high-pressure water between the rotary heads which face [carrying out descaling with the high-pressure water injected from the nozzle attached in two or more sets of the rotary heads arranged crosswise / that] elevated-temperature steel materials which were taken out from the heating furnace according to this invention, such as hot slab and a steel plate, and adjoin is prevented, and useful effectiveness is brought about on the industry which can carry out descaling to homogeneity in high efficiency crosswise.

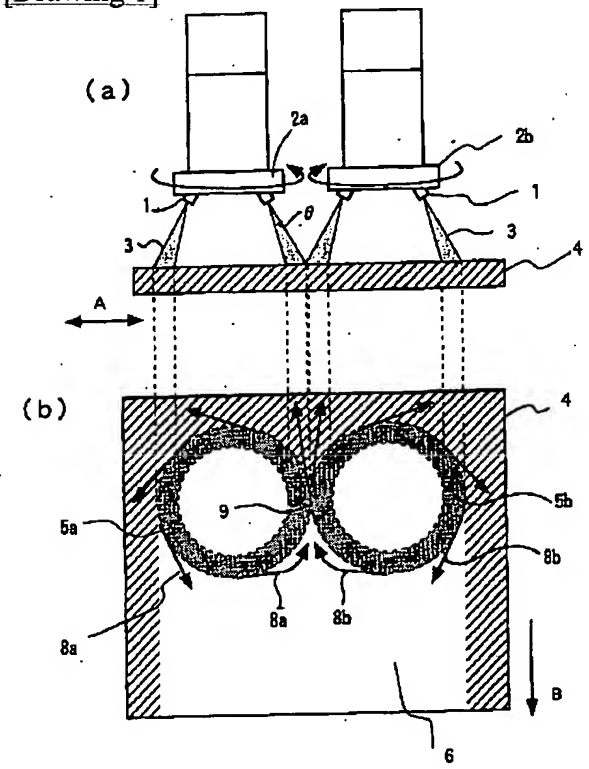
[Translation done.]

* NOTICES *

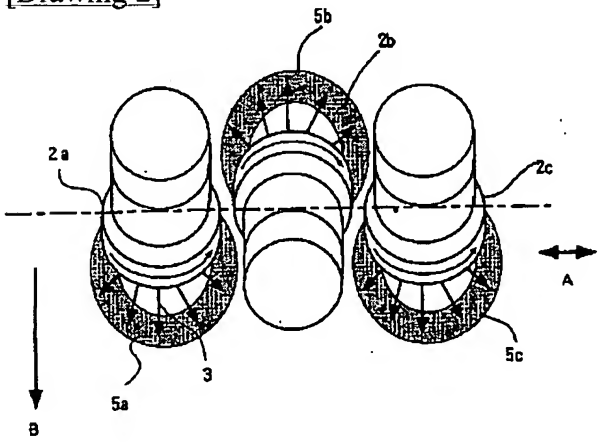
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

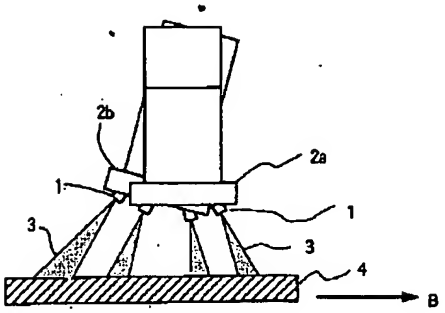
[Drawing 1]



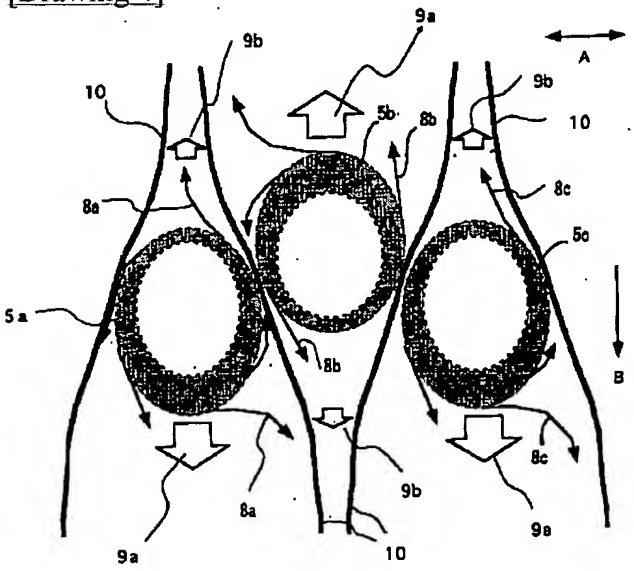
[Drawing 2]



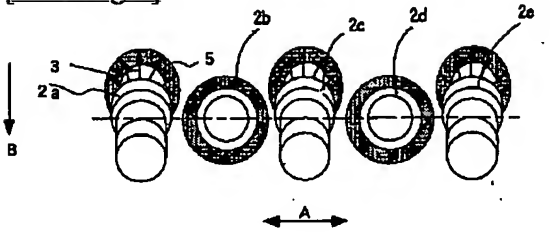
[Drawing 3]



[Drawing 4]



[Drawing 5]



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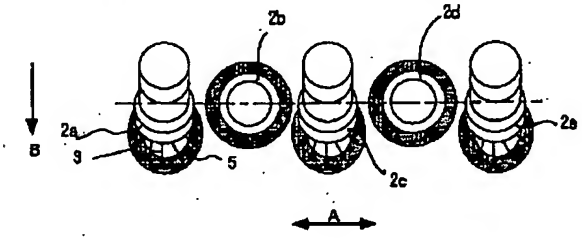

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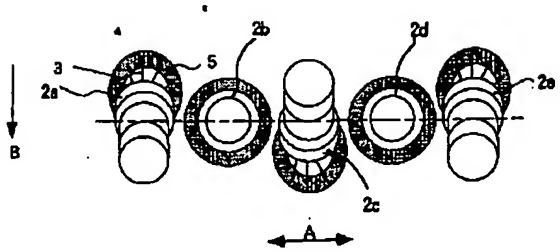

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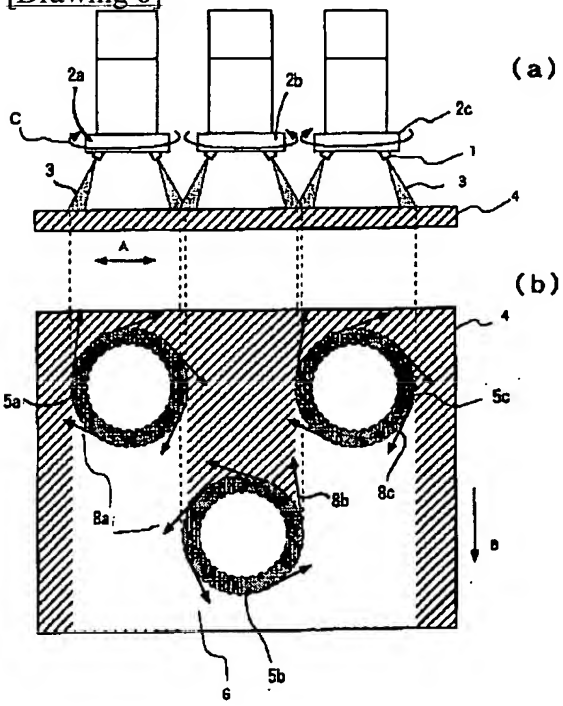
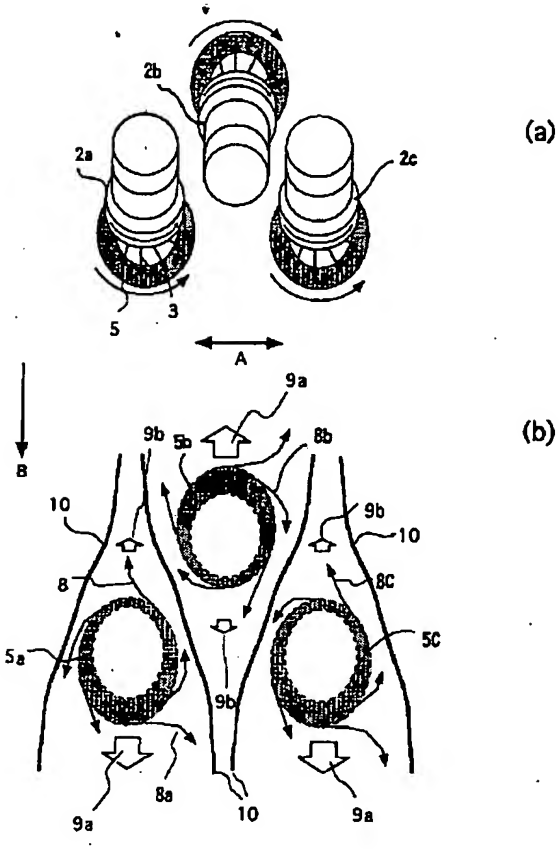


[Drawing 9]



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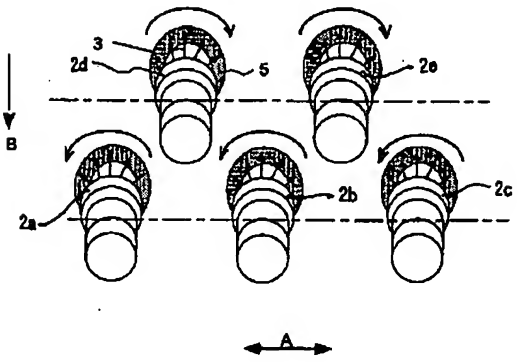

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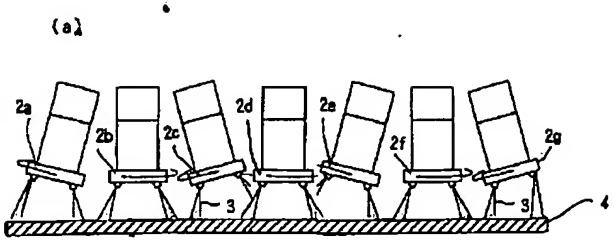

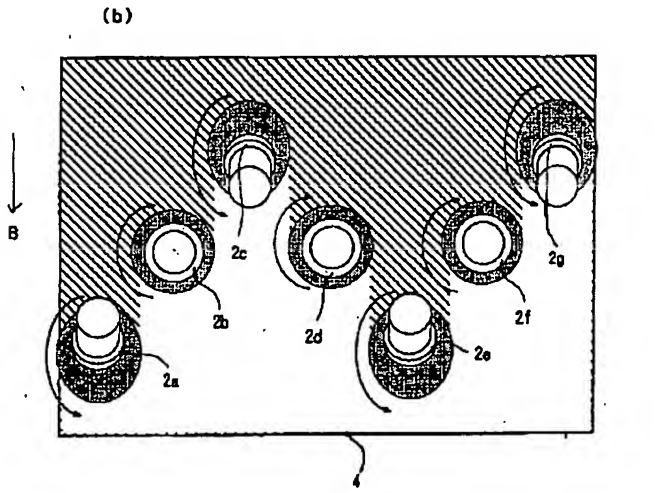

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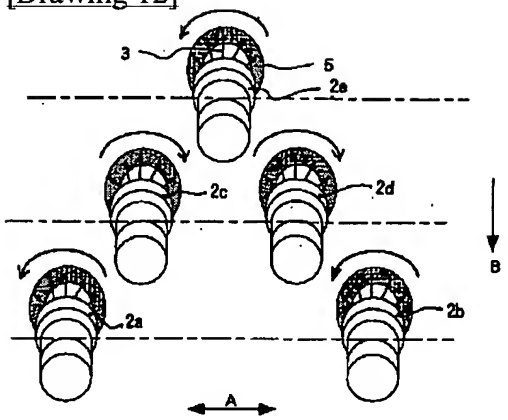
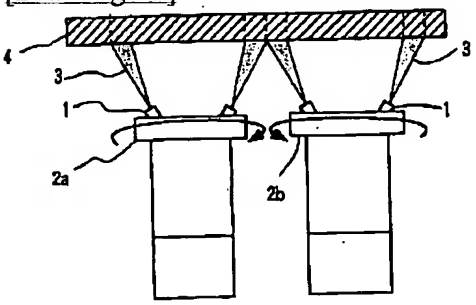
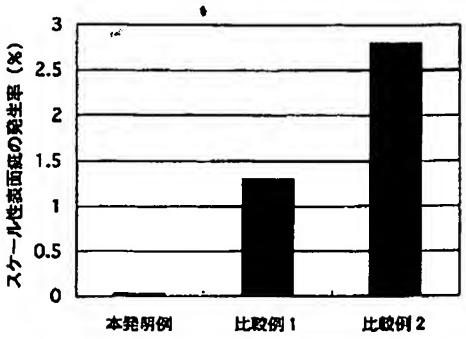


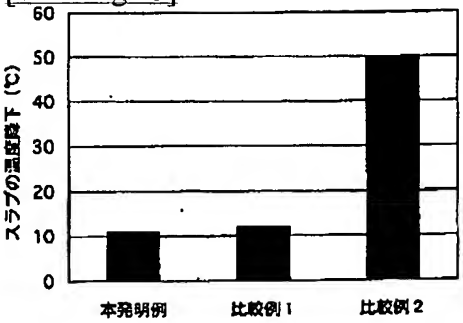
[Drawing 13]



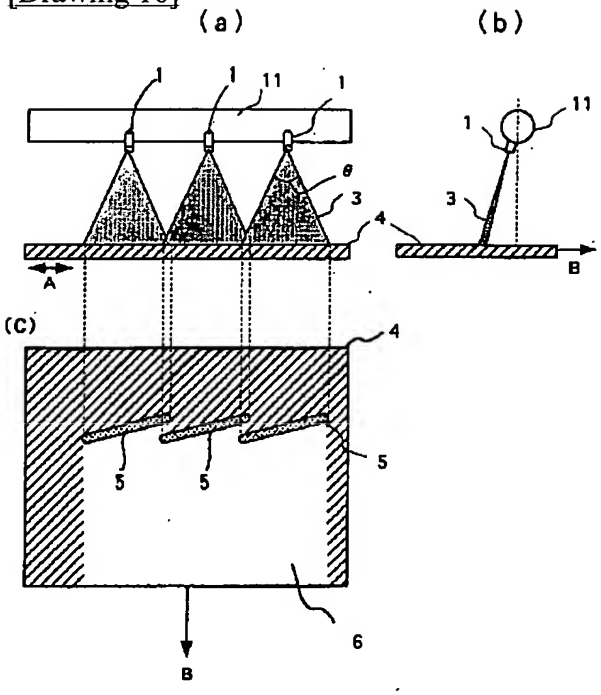
[Drawing 14]



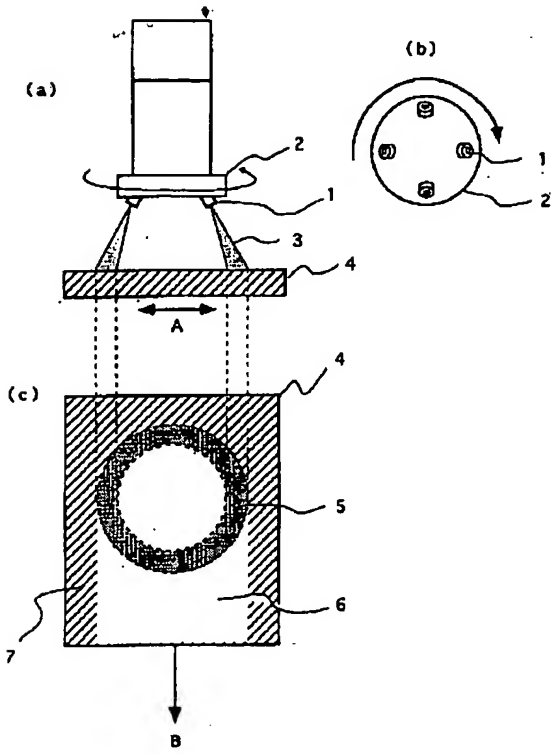
[Drawing 15]



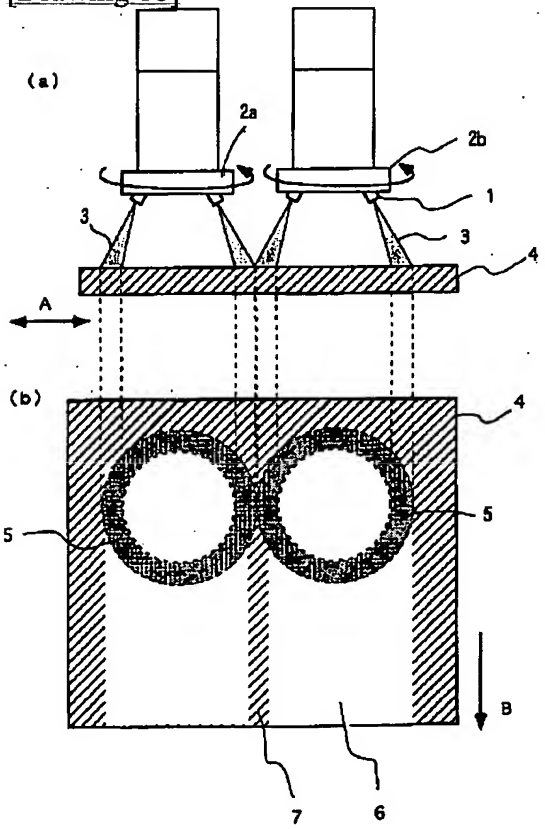
[Drawing 16]



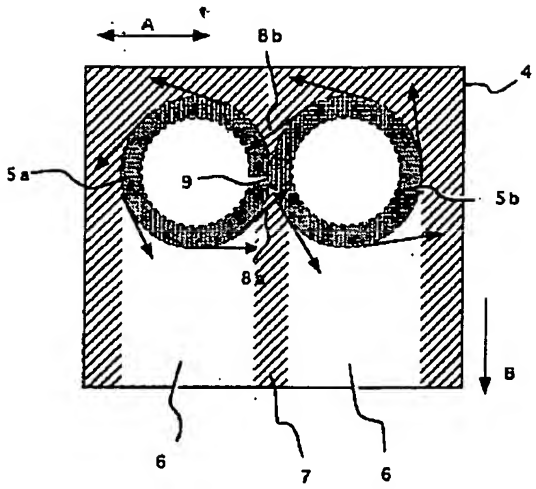
[Drawing 17]



[Drawing 18]



[Drawing 19]



[Translation done.]